through the glass. Shut one eye so as to get rid of binocular perspective.

You can now at will change the relative position of the two parts of the rim. At one moment you see the farther rim through the glass in its true position; at another it seems the nearer of the two and you seem to be looking into the mouth of the goblet.

Now, if the glass were rotating, it is evident that it would seem to rotate in the one direction or the other, according as we imagined the real or the reversed position of the rims.

The phenomena can be seen with both eyes open, but is clearer with one eye shut for the reason already given.

Now, I think the phenomenon of the rotating fan is explained in a similar way. The observer, I suppose, looked at the fan from a little *below* the horizontal, but seemed to be looking at it from *above*, when the rotation was apparently reversed.

JOSEPH LECONTE.

BERKELEY, CAL., September 24, 1898.

[A similar explanation has been sent us by Mr. Garrett P. Serviss, Jr. It is the explanation of Sinsteden, who first described the phenomenon in 1860, as stated above by Mr. Pierce. *Cf.* von Helmholtz, *Physiol. Optik.*, 1895, p. 770.—ED. SCIENCE.]

SCIENTIFIC LITERATURE.

Memoirs from the Biological Laboratory of the Johns Hopkins University, IV., 1. *The Cubomedusæ.* A Dissertation presented for the Degree of Doctor of Philosophy, in the Johns Hopkins University, 1897. By FRANKLIN STORY CONANT. A Memorial Volume. Baltimore. 1898.

The late Dr. Conant, it will be recalled by many, was a member of the marine laboratory of the Johns Hopkins University, stationed during the summer of 1897 at Port Antonio, Jamaica. Toward the end of the season's work fever broke out. The director of the expedition, Dr. J. E. Humphrey, died in a sudden and alarming manner. Dr. Conant assumed charge of the laboratory, and, though aware of his own great danger, remained in Port Antonio, devoting himself to the service of others who needed his help. This generous subordination of self cost him his life, for he contracted the fever, and, though able to reach this country, he died a few days after his arrival in Boston.

Dr. Conant's many friends, well aware of his candid, judicial mind, his keenness and persistency in observing and in reasoning from observations to a conclusion, have entertained the highest expectations of the work he was to do in science. Cut off at the beginning of his career, he leaves behind him several smaller papers and the dissertation before us. On closing this volume the author's friends will feel confirmed in their high opinion of his abilities, and those who did not know Dr. Conant will realize with regret that an able and conscientious naturalist has been removed from our midst.

Dr. Conant's dissertation, published as a memorial volume by his friends, fellow students and instructors, with the aid of the university in which he had recently taken his doctor's degree, deals with the anatomy and classification of one of the most interesting groups of jellyfish, the Cubomedusæ. In this group, embracing but a small number of species, the scyphomedusan structure, with which most of us are chiefly familiar through the study of *Aurelia*, *Cyanea* or *Dactylometra*, is in general presented as destitute of the complications which characterize the more common forms. This simplicity in general structure places the group close to the stem-forms, *Tessera* and *Lucernaria*, themselves scarcely more than sexually ripe *Scyphistomas*, and makes a comparison with existing Actinozoa an easy matter. Curiously enough, the members of this primitive group possess the most highly developed sense-organs as yet described among coelenterates, the nervous system being correspondingly differentiated. In one other respect the Cubomedusæ are unique, in that they alone among the Scyphomedusæ possess a velum. The phylogenetic origin of this velum (velarium) has been the subject of some discussion, the balance of opinion inclining to the belief that it has arisen through the fusion of marginal lobes similar to those found in the Peromedusæ and the Ephyropsidæ (*Nausithoë*), and is merely analogous to, not homologous with, the velum of the Hydromedusæ. That this is the case is borne out by the presence in the velum of gastrovascular diverticula. This

resemblance to the Hydromedusæ is regarded by most naturalists as one of the numerous cases of convergent evolution exhibited by the two groups of jelly-fish (Hydro- and Scyphomedusæ), due to similarity in environment and to a certain similarity in the ancestral polyps from which the two groups have been derived.

The Cubomedusæ are so rare that in spite of their interesting features, interesting alike to the student of phylogeny and nerve-physiology, few naturalists have had the opportunity of studying them. Our knowledge of the group has rested mainly on Claus's description of *Charybdea marsupialis* (Wien. Arb. 1878). This very valuable paper, as Conant remarks, is written in a style difficult of comprehension, and many students who read with pleasure and profit the lucid treatises on medusan structure by the Hertwigs and Haeckel have turned away discouraged from Claus's work. To Claus's account, Haeckel in his 'System' has added but little. The only other investigator the group of is Schewiakoff (1889), who has studied the remarkable sense organs.

Through Conant's discovery in 1896 of two new species (*Charybdea Xaymacana* and *Tripedalia cystophora*), which are present in abundance in Jamaican waters, the Marine Laboratory of the Johns Hopkins University has once again made accessible to students, material for the pursuit of investigations of wide interest. It was for the purpose of continuing his study of this group that Conant, in the summer of 1897, revisited Jamaica, and, as we learn from Professor Brooks's introduction, he succeeded in making many observations on the physiology of the sense-organs and on the embryology. His notes and material, we are told, are in such shape that they can be handed over to some one else, and it may be safely predicted that a valuable contribution to science will be the outcome of the last summer's work of this talented young naturalist.

The account of the subomedusa structure given by Dr. Conant is succinct, but comprehensive. The deep, four-sided bell bears a tentacle (or in some species a bunch of tentacles) at each angle. On each lateral surface, at a higher level than the tentacles, is situated a niche into which projects a sense-organ. The primitively undivided (Scyphistoma condition) gastrovascular space is here differentiated into a central stomach and a peripheral portion lying in the lateral wall of the bell. The peripheral portion is subdivided into four stomach pockets by linear partitions, lying in the plane of the tentacles and therefore interradial. These partitions (cathammæ) are mere strips of entodermal lamella, produced by the fusion between the entodermal linings of ex- and subumbrella. The cathammal lines stop short of the tentacles, leaving an undivided peripheral portion of the primitive space, by means of which the four stomach pockets communicate with one another. As Conant points out, the arrangement recalls the gastrovascular system of many Hydromedusæ, with the difference that in the Cubomedusæ the radial canals are wide 'stomach pockets' and the cathammal plates are narrow lines. When we come, however, to the extreme peripheral portion of the gastrovascular system, we find that the likeness is not with the Hydromedusæ, but with the lobed Scyphomedusæ. The gastrovascular space, to be brief, does not end with an even circular edge at the bell margin, as is the rule in the former group, but is divided into separate lobes (marginal pockets) extending into the velum (as velar canals). Conant does not dwell on phylogenetic inferences, but evidently inclines to the belief that the ancestors of the Cubomedusæ possessed a margin divided into sixteen lobes. The present position of the four sense organs indicates the site of the original margin, "which elsewhere has grown down and away from its former level, leaving the sensory clubs like floatage stranded at high-water mark." Fusion between adjacent lobes, involving the ectoderm and jelly, gave to the medusa a continuous margin and a 'velum,' but, owing to the incompleteness in the fusion of the *entodermal linings* of the several lobes, the latter still retain in the adult Cubomedusa enough of their individuality to indicate their former condition. In a word, the marginal pockets of the existing Cubomedusa are to be construed as entodermal linings of once separate lobes.

This conclusion as to the morphology of the marginal pockets derives much support from the behavior of a puzzling structure, called by

Conant the marginal lamella. Unlike the true vascular lamella, which simply connects one entodermal cavity with another, the marginal lamella extends from the entoderm of the gastrovascular space to the ectoderm of the bell margin. It is a narrow strip which follows the outline of the marginal pockets, traveling in the radii of the sense organs far away from the actual edge of the bell, and surrounding the sense organs in such a way as to indicate clearly that they were once at the bell margin. The marginal lamella seems to be a functionless, rudimentary organ. Claus, whose imperfect description of the structure did not bring to light its morphological interest, as indicating the site of the ancestral bell margin, suggested that it was perhaps the vestige of a ring canal. Conant naturally is skeptical of this explanation of a lamella connecting ento- and ectoderm. The true meaning of this peculiar lamella is a point well worth working up, more especially as it is not confined to the Cubomedusae, but has been observed in the ephyra lobes of discophores (*Rhizostoma*).

Before leaving this subject of the general body-plan, it may be mentioned that while the probability is that the Cubomedusæ are descended from stalked ancestors (*Luceruaria*-like forms), and hence that the apex of the exumbrella was once drawn out into a peduncle, there is in the adult Cubomedusa no trace externally nor internally of this hypothetical stalked condition. Light on this very interesting point can only be expected from a study of the development.

Unlike the other Scyphomedusæ studied, the Cubomedusæ possess a nerve ring. In their study of the nervous system Claus and Conant both depended on sections, and naturally the results are not so satisfactory as those reached by the Hertwigs on the Hydromedusæ mainly with the aid of macerations. Claus describes the neuro-epithelium as consisting of alternating supporting cells and sensory cells, the inner ends of the latter becoming continuous with the nerve fibres. Conant makes it doubtful whether this is the actual condition, since he does not find the sensory cells. He offers, however, no observations on the origin of the 'nerve fibres.' Macerations will probably show the connection of these fibres with at least some of the neuro-epithelium cells.

The possession of a nerve ring has been regarded (Claus) as a point of essential similarity between the Cubomedusæ and the Craspedota. The main ring in the former group is obviously a differentiation of the subumbrellar epithelium, and Claus, therefore, interprets it as homologous with the inner Craspedote ring. In the immediate neighborhood of each sense organ there are given off from the main ring two roots which *ceasing to be superficial bands* pass through the jelly, and emerge on the outer wall of the bell (on the floor of the sensory niche). They converge and unite, forming a superficial nerve tract which crosses the base of the sense-club. These four isolated tracts are regarded by Claus as the remnants of a once continuous exumbrellar ring, such as is found in the Hydromedusæ, and which here, as in the Hydromedusæ, stands in connection with the subumbrellar ring though the medium of fibres that perforate the jelly. Conant, on the other hand, regards the tracts lying across the bases of the sense organs as portions of the primitive subumbrellar ring which were shut off from the main ring, when the marginal lobes grew together. With the Hertwigs and Haeckel he thus looks on the ring as not homologous with that of the Craspedota, but as a special differentiation of the subumbrellar plexus found throughout the Scyphomedusæ.

The sense organs of the Cubomedusæ are 'sense-clubs,' or modified tentacles. In addition to the crystalline sac, the expanded head of the club bears six eyes. Four of these are simple, but two are complex organs provided with a cellular lens and cornea, a vitreous body behind the lens, and a retina. These eyes look into the bell cavity. It is especially in reference to the structure of the retina and vitreous body of the complex eyes, that Conant's conclusions differ from those of Schewiakoff. The vitreous body Conant finds is not a homogeneous structure, but is composed of prisms of refracting substance. The retina does not show the two types of cells (sensory and pigmented) distinguished by Schewiakoff. Conant's results in this matter of the retinal structure are in some respects negative. The points still to be

cleared up are as in the case of the nerve cord, such as will require the free use of macerations and surface preparations of fresh tissue.

H. V. Wilson.

SCIENTIFIC JOURNALS.

The American Journal of Science for October opens with an important article by Professor C. Barus, describing experiments on the impressibility of celloids. The author points out that as with gelatine the same body may manifest itself both as a liquid and a solid, so the same ether may act, as the case may be, either as a liquid or as a solid. Professor C. E. Beecher concludes his series of articles on the origin and significance of spines. He has shown that spinose forms were all derived from non-spinose ancestors, and were simple and inornate during their young stages. Spines represent an extreme of superficial differentiation and out of spinose types no new types are developed. Director Chas D. Walcott writes on the brachiopod fauna of the quartzitic pebbles of the Carboniferous conglomerates of the Narragansett Basin and Rhode Island. The number also includes articles on the eolian origin of loess, by C. R. Keyes; on dikes of felsophyre and basalt in Paleozoic rocks in central Appalachian Virginia, by N. H. Darton and A. Keith; on diaphorite from Montana and Mexico, by L. J. Spencer; on the detection of sulphides, sulphates, sulphites and thiosulphates in the presence of each other, by P. E. Browning and E. Howe, and on twinned crystals of zircon from North Carolina, by W. E. Hidden and J. H. Pratt.

The *American Naturalist* for September publishes the Vice-Presidential addresses at Boston of Professors Packard and Farlow and contains in addition an article by Mr. E. O. Hovey, describing the museums he visited last year when in Europe attending the International Geological Congress. Special attention is paid to geology, mineralogy and paleontology.

Professor H. Poincaré, of the University of Paris, contributes to the October *Monist* an article 'On the Foundations of Geometry,' in which he considers the questions of the origin of space and the feeling of direction, of the classification of displacements, of the properties of groups and sub-groups, of continuity and discontinuity, of the notion of point and number of dimensions, etc. In the same number Professor Ernst Schroeder, of Karlsruhe, has an article 'On Pasigraphy,' in which he sums up the history of the movement, and briefly characterizes the present state of research in this department. Dr. Topinard concludes his series, 'Science and Faith,' with an article on 'The Social Problem,' in which he outlines a plan for the rehabilitation of society by systematic interference with the workings of so-called 'natural' evolution.

The *Educational Review* for October contains the following articles: 'The Public Education Association of New York,' by Mrs. S. Van Rensselaer; 'Study of Education at the German Universities,' by Walter L. Hervey; 'Herbartian Philosophy and Educational Theory,' by Arnold Thompkins; 'Why College Graduates are Deficient in English,' by Annie E. P. Searing; 'The New Jersey System of Public Instruction,' by James M. Green, and 'What Modern Philosophy Offers Secondary Education,' by O. L. Manchester and H. H. Manchester.

NEW BOOKS.

Thermodynamics of the Steam-engine and other Heat-engines. Cecil H. Peabody. New York, John Wiley & Sons; London, Chapman & Hall, Ltd. 1898. 4th Edition. Rewritten and Reset. Pp. iv + 522. $5.00.

The Discharge of Electricity through Gases. J. J. Thomson. New York, Charles Scribner's Sons. 1898. Pp. x + 203. $1.00.

Theories of the Will in the History of Philosophy. Archibald Alexander. New York, Charles Scribner's Sons. 1898. Pp. viii + 357. $1.50.

Four-footed Americans and Their Kin. Mabel Osgood Wright. Edited by Frank M. Chapman. New York and London, The Macmillan Company. 1898. Pp. xii + 432.

Differential and Integral Calculus. P. A. Lambert. New York and London, The Macmillan Company. 1898. Pp. x + 245. $1.50.

An Introductory Logic. James Edward Creighton. New York and London, The Macmillan Company. 1898. Pp. xiv + 392. $1.10.